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The impact of the use of mobile computing on vocabulary learning in the language classroom

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The impact of the use of mobile computing on vocabulary learning in the language classroom

Abstract

Mobile computers offer accessibility anytime and anywhere, and they are being used more and more for teaching and learning. The purpose of this review is to explore the impact of using mobile applications and devices in vocabulary learning among language learners. The review also addresses the perceptions of students and teachers regarding the use of mobile computers in the classroom. In this paper, thirty peer-reviewed journal articles published in the last eleven years were critically analyzed. From the reviewed research, it was found that using mobile computers not only enhances vocabulary learning and retention but also contributes to students' motivation to learn. Some considerations need to be kept in mind when using mobile computers in the classroom as students and teachers reported some challenges when using them

Keywords: mobile computing, vocabulary learning, language classroom

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The Impact of the Use of Mobile Computing on Vocabulary Learning in the Language Classroom

A Graduate Review

Submitted to the

Division of Instructional Technology

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Lorena Harger

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This Review by: Lorena Harger

Titled: The Impact of the Use of Mobile Computing on Vocabulary Learning in the Language Classroom

has been approved as meeting the research requirement for the

Degree of Master of Arts.

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Abstract

Mobile computers offer accessibility anytime and anywhere, and they are being used more and more for teaching and learning. The purpose of this review is to explore the impact of using mobile applications and devices in vocabulary learning among language learners. The review also addresses the perceptions of students and teachers regarding the use of mobile computers in the classroom. In this paper, thirty peer-reviewed journal articles published in the last eleven years were critically analyzed. From the reviewed research, it was found that using mobile computers not only enhances vocabulary learning and retention but also contributes to students' motivation to learn. Some considerations need to be kept in mind when using mobile computers in the classroom as students and teachers reported some challenges when using them.

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The Impact of the Use of Mobile Computing on Vocabulary Learning in the Language Classroom

Introduction

As a foreign language teacher walks in the hallway after school, one of her 9th grade students asks if she could greet a friend in Spanish. The student was using FaceTime to communicate with a friend from another country. The teacher greets the student's friend and as she continues to walk to her classroom, she notices that the student was carrying on a conversation in Spanish with his friend. This student later shared with the teacher that he and his family traveled to Guatemala on a service mission and he had made some new friends his own age in that country. This experience sparked a strong interest to learn more Spanish. This student is now trying to improve his learning by practicing with his friend. The student explained how exchanging text messages in Spanish has helped improve his vocabulary and how using Face time has helped his listening skills. The main goals of teaching and learning are demonstrated in the previous scenario where students learn concepts in school and apply them outside the classroom using ubiquitous tools such as mobile devices to continue the learning process.

This new generation of students lives through technology. It offers ubiquitous and immediate access to people and resources around the world. Based on research exploring the instructional value of technology, Cakir (2015) argues mobile devices should be incorporated in the school curriculum as they are "expected to serve pedagogically useful functions in education" (p. 240).

In order for students to build their knowledge in a second language it is crucial that they learn vocabulary (Azabdaftari & Mozaheb, 2012, p.48). Echevarria & Short (2010) stressed "the

importance of building a broad vocabulary base for students to be effective readers, writers, speakers and listeners" (p. 275). Furthermore, the authors state that "key vocabulary needs reinforcement through different learning modes to put the knowledge of the words into the students' expressive vocabulary tool set" (Echevarria & Short, 2010, p. 275). Many of the traditional tools used to teach a foreign language do not connect with this new generation of students. Flashcards are being replaced by apps on mobile devices.

This review will focus on the effects of using mobile computing in vocabulary learning. Research into this area has been done primarily at the postsecondary level with some research being conducted in high school classes. The major themes when researching mobile computing in language learning and more specifically in vocabulary building are: 1) vocabulary learning using mobile devices, and 2) perceptions of mobile devices in the classroom. The reviewed research explores how mobile devices can be used for vocabulary learning in the foreign language classroom, the subtopics on this major theme are: mobile dictionary use, the use of SMS (Short Message Services or Texting), and mobile learning versus flashcards.

Considering the many features and applications that mobile devices offer, the goal is to explore how they are being used in the classroom to improve their vocabulary skills and learning experiences with these digital tools. Vocabulary learning plays an important role in developing fluency in a foreign language (Zhang, Song, & Burston, 2011, p. 203). The use of mobile devices in language learning has "positive effects on the learning process" (Basoglu & Akdemir, 2010, p. 1). This review will be helpful for world language teachers, administrators and other staff working with high school students in providing guidance for using mobile devices to support vocabulary learning. By exploring the effects of mobile computing in language learning, teachers

can make decisions on how to better use this tool in their classroom. School administrators will be able to make decisions regarding the use of technology for teaching and learning.

For the purpose of this review, *mobile learning* is defined as the "The learning mode that employs mobile technology/devices to facilitate or support learning" (Nikolopoulou, 2020, p. 2). The technology used in mobile learning includes handheld mobile devices such as smartphones, pads, pods, laptop, and tablet computers (Bachore, 2015).

Methodology

In order to locate resources for this paper, several online databases were used. The researcher used ERIC (Thesaurus), Google Scholar, and EBSCO (through the University of Northern Iowa's Rod Library). Using Google Scholar, some resources were found by reviewing the citations within the journals and studies located initially. Descriptors/keywords used to find resources for this paper were: *Mobile phones, learning tools, foreign language learning, digital learning, handheld devices,* and *technology integration.*

The resources' titles were examined, as well as the abstract and method sections. Based on these sections the information was analyzed and the resources were selected. The resources found for this paper were evaluated based on the following characteristics: the resources clearly related to the topic, the information came from reports of original research, the resources were peer-reviewed articles/studies from reputable journals, and they were considered current for the topic. Other indicators that were considered by the researcher were quality of research, sample size, and methodology. This review includes over thirty peer-reviewed articles from 2008 to 2020. The studies used qualitative and/or quantitative research method to examine the effects of using mobile devices in vocabulary learning in the foreign language classroom, and the perceptions of teachers and students regarding the use of mobile computing for learning.

Analysis and Discussion

This review will focus on the effects of using mobile computers in vocabulary learning in the foreign language classroom. Mobile devices can be a great tool for teaching and learning a foreign language. They can help increase motivation for learning in students (Suwantarathip & Orawiwatnakul, 2015, p. 163) as they can access this tool anytime and anywhere. Two major themes emerged in the literature: 1) vocabulary learning using mobile devices, and 2) perceptions of teachers, prospective teachers, and students concerning mobile devices in the classroom.

Vocabulary Learning Using Mobile Devices

The literature explores the effect of using mobile devices for vocabulary learning compared to traditional methods. For example, some researchers compared learning vocabulary using mobile devices to using paper flashcards (Basoglu & Akdemir, 2010; Azabdaftari & Mozaheb, 2012; Nikoopour & Kazemi, 2014). Rahimi & Miri (2014) and Rezaei & Davoudi (2016) compared using a mobile dictionary versus a printed dictionary for learning vocabulary. Some researchers investigated the impact of mobile apps on foreign language learning (Sato, Murase & Burden, 2015; Wu, 2014; Berns, Palomo-Duarte, Dodero, Ruiz-Ladrón & Calderón Márquez, 2015; Yafei & Osman, 2016; Rezaei, Mai & Pesaranghader, 2014). Other researchers explored the use of SMS (Short Message Service) via mobile computers in foreign language learning (Suwantarathip & Orawiwatnakul, 2015; Lu, 2008; Zhang et al., 2011; Alemi et al., 2012; Derakhshan & Kaivanpanah, 2011; Motallebzadeh & Ganjali, 2011; Kim, 2011). Research also included measuring the effectiveness of instructional lessons and activities on mobile devices in learning vocabulary (Agca & Özdemir, 2013; Miyakoda, Kaneko, & Ishikawa, 2011; Khazaie & Ketabi, 2011). Lastly, some researchers investigated vocabulary learning via

mobile-assisted authentic content creation (Wong & Looi, 2010; Qin, 2015).

Digitized vs. Paper Flashcards

A few research teams explored vocabulary acquisition via digitized tools versus paper flashcards using a sample group of undergraduate students (Basoglu & Akdemir, learning 2010; Azabdaftari & Mozaheb, 2012; Nikoopour & Kazemi, 2014). These researchers hypothesized that using mobile computers with vocabulary programs could improve students' vocabulary skills more than using paper flashcards. Basoglu & Akdemir worked with 60 participants, for 6 weeks, who learned approximately 1000 words. They found that both groups improved their vocabulary skills, however the students using the vocabulary learning program in their mobile phones had significantly higher vocabulary gains than the group using paper flashcards. Basoglu & Akdemir used ECTACO Flash Cards (Version 2.48.0; 2010), a vocabulary acquisition program operating on students' mobile phones. The content was scanned, and the vocabulary lists were made available for student use.

In the study by Azabdaftari & Mozaheb (2012), students in the experimental group used a SRS (Spaced Repetition System) vocabulary acquisition program as their mobile software. Like Basoglu & Akdemir (2010), the required vocabulary words were scanned into the system and then the program was used to teach the new vocabulary words. Azabdaftari & Mozaheb, using a sample group of 80 upper intermediate English level students for a 7-week period, introduced about 1200 new words. An independent t-test was run. The mean score for the experimental group was 65, and the mean score for the control group was 45 (SD=13). This result indicates that there is a significant difference between the two groups ($t(78) = 6.99$, $p<0.05$). Azabdaftari & Mozaheb findings were in line with Basoglu & Akdemir. They found that using mobile learning improves the level of the learned vocabulary of the students more than the paper

flashcards (Azabdaftari & Mozaheb, 2012).

On the other hand, Nikoopour & Kazemi (2014) used two experimental groups: Mobile based and online groups. The researchers worked with 109 advanced EFL learners during their 10-week-long treatment time covering a total of 700 words. Nikoopour & Kazemi designed a software package for the mobile-based flashcards group. The participants in this group had access to the material only through their cellphones in the form of video clips. They had continuous access because the program was housed on their phones. For the online group, the researchers hired a designer to design a website where flashcards were uploaded weekly and the learners accessed them through the web. These learners could only access their study materials when they had Internet access. The researchers found that the Mobile Group outperformed the Online Group. The researchers indicated that the reason for the difference in the scores of these two groups was "due to the portability and high accessibility of cell phones" (p. 1371). While the Mobile Group worked offline using their devices, the online flashcards group was affected by limited Internet access which in turn limited their study time. This affected the overall results of the Mobile and Online flashcards groups, indicating that there was no significant difference in vocabulary learning when digitized tools and paper flashcards were used.

In addition to exploring vocabulary gains using digitized tools (Mobile and Online flashcards) compared to using paper flashcards, in the three previous studies the researchers interviewed the students as well. They asked students about their experiences using the vocabulary program on mobile devices as a learning tool. The participants in the aforementioned studies had a positive attitude towards using mobile devices for vocabulary learning due to the accessibility, portability, and ubiquity of these devices (Basoglu & Akdemir, 2010; Azabdaftari & Mozaheb, 2012, Nikoopour & Kazemi, 2014). For example, in the study by Basoglu and

Akdemir, a participant stated that "studying with mobile phone [*sic*] is more effective and fun for me [than on paper] since it is available all the time" (p. 5). Additional advantages mentioned by participants were the instant feedback they received as they submitted the correct answer, the interaction among students, and connections between students and instructors (Azabdaftari & Mozaheb, 2012). In the study by Azabdaftari & Mozaheb, the researchers not only asked for advantages of mobile devices in language learning but also for challenges. As disadvantages, students mentioned the small screen for some mobile devices, the limited capabilities of some phones, and the cost of Internet access.

Mobile Dictionary vs. Printed Dictionary

Research has also explored vocabulary acquisition using a mobile dictionary compared to a printed dictionary (Rahimi & Miri, 2014; Rezaei & Davoudi, 2016). Using a sample group of 34 lower-intermediate language learners during a 16-session semester, Rahimi & Miri, found that the learners who used the Mobile Dictionary (MD) for second-language learning improved their language ability more than the students who used the Printed Dictionary (PD.) Students completed a pretest and posttest to assess their language ability. For the posttest, the mean of the experimental group was 85.29 (SD=9.026), and the mean of the control group was 77.35 (SD=7.598). The result of a one-way between groups analysis of covariance indicated that this was a significant difference between the two groups' improvement ($p<0.05$).

In the study by Rezaei & Davoudi (2016), the authors not only explored the influence of MD vs. PD on vocabulary learning but also on vocabulary retention. The researchers used a sample group of 70 college students during fifteen sessions. In order to assess short-term memory, participants completed a posttest immediately after the last treatment session. The delayed test was taken two weeks after the last treatment session for long-term retention. The

means of the immediate posttest for the MD group was 50.75 (SD=3.585) and for the PD group was 38.53 (SD=3.245). An independent sample t-test indicated that the difference between the groups was significant. In the delayed posttest the mean of the MD group was 55.96 and the mean of the PD group was 46.57. The results of another independent sample t-test indicated that the performance of the two groups on the delayed posttest was significantly different. The MD group showed greater vocabulary retention than the PD group. The authors suggest a combination of paper and electronic dictionary features in order to improve vocabulary retention in both the immediate and delayed situations. The researchers also found that students were more motivated to learn new words when they were able to use electronic tools (p. 146).

Apps

Other researchers used apps or applications for language learning (Wu, 2014; Sato, Murase & Burden, 2015; Rezaei, Mai & Pesaranghader, 2014; Berns, Palomo-Duarte, Dodero, Ruiz-Ladrón & Calderón Márquez; 2015; Yafei & Osman, 2016). Apps can be effective tools for vocabulary learning, and many of them can be downloaded to mobile devices for free or at a low cost. Apps can be used while “on the go” or while the user is working on a specific learning task (Nisbet & Austin, 2013). For example, in the study by Wu (2014) students in the experimental group used Word Learning, a JAVA application software (Wu, 2013), installed on their phones. Participants could practice different aspects of the vocabulary words as this software included seven features: spelling, pronunciation, meaning of words, synonym, antonym, part of speech, and example sentences. Students in the experimental and the control group were encouraged to study vocabulary items daily. The difference was that students in the control group did not have access to the app. The study lasted one semester with four class hours per week. Each of the 50 Participants in this study was expected to learn 852 vocabulary words. Students took a posttest

after treatment, the mean score for the experimental group was 74.04 (SD=12.408), and the mean score of the control group was 44.60. The results indicated that there was a significant difference between the two groups. The researcher stated that using vocabulary learning software helped the users by having access to the material anytime. The researcher mentioned that she "noticed that students in the experimental group were becoming better autonomous learners" (p. 305).

Sato et al (2015) found results similar to those of Wu (2014). Sato et al. explored the use of Quizlet, an online learning tool with vocabulary learning resources, which also offers a mobile app. The researchers worked with 97 undergraduate students for the three-week study. The control group (CG) used a paper-list for their vocabulary and the experimental group (EG) used their phones. Students took a timed test 3 weeks after treatment. Students were given 10 minutes to complete the twenty fill-in-the-blank questions test. The scores and duration of the test were compared. The CG (N=45) mean score of the test was 6.18 (SD=6.02) and the mean of the time was 539 seconds (SD=119), and for the EG the mean score of the test was 9.14 (SD=6.43) and the mean of the time was 532 seconds (SD=110). The results indicated that there was a significant difference between the two groups with respect to average score ($t(95)=-2.33$, $p<0.05$), but no significant differences regarding test duration ($t(95)=0.28$, $p>0.05$). Using mobile devices allowed students to have easy access to the material, which helped with enhancing the recollection of the target words. In addition to this, the researchers found that learning a language using mobile technology may have a motivational effect.

Apps can help a class become a community of learners. For example, Berns et. al (2015) created an app called *Guess it! Language Trainer* which gives the users the opportunity to collaborate with other users as they build their knowledge in a foreign language, as well as assess their language learning progress. As students play the app to practice the vocabulary, the teachers

can see the interactions of the students with the app, which helps teachers to assess the students' progress. The researchers worked with a German language class of 100 students from a Spanish university. After four weeks, the researchers found an average of 5.35 points of difference in range (from 0 to 10) between the pre-tests and post-tests 3 scores. These results indicate using the app caused a significantly positive effect on students' vocabulary learning.

Yafei & Osman (2016), not only investigated the impact of using mobile apps on vocabulary learning but also on vocabulary retention. For this purpose, the researchers completed an immediate and a delayed posttest. The participants consisted of 46 11th grade students from two schools. The experimental group consisted of 22 students, and 24 students composed the control group. Students in the control group received assignments and feedback in traditional paper format, while the students in the experimental group received them via the KO-SU mobile app. The results of the post-test indicated that there was no significant difference in vocabulary achievement between the two groups. The researchers suggested that these results were due to the lack of familiarity with the platform, given that the experimental group had used mobile-based exercises for only two weeks. This result is not consistent with findings from previous studies, also exploring the use of apps (Wu, 2014; Sato et al, 2015). On the other hand, the results of the delayed posttest indicated that there was a significant difference in vocabulary retention between the two groups in favor of the experimental group. After completing the delayed posttest, students were asked if they reviewed the material after the posttest. Less than half of the students in the control group reviewed their papers' exercises while many of the participants in the experimental group referred back to the vocabulary exercises since they were accessible via their phones at all times.

The aforementioned studies on apps, used a control and experimental group. In contrast,

Rezaei et. al (2014) did not use a control and experimental group. In their work with 42 pre-intermediate level English learners, the researchers examined the learners' performance before and after using Busuu and Interactive English mobile apps for vocabulary acquisition. The participants were divided into two study groups, 19 students in study group 1 and 23 participants in study group 2. The experiment in both study groups lasted two months. After two weeks of traditional teaching, students in both groups took a pre-test. Then, the instructor introduced the applications to both groups, and provided explanation to help with the interaction. After six weeks of the study, participants in both groups took a post-test. The mean for all pretest scores in study group 1 and in study group 2 was 13.24, whereas the mean for all posttest scores in study group 1 and study group 2 was 15.82. These results indicate an improvement of 2.58 for the scores in both Study groups. From these results, the researchers concluded that using mobile applications had a significantly positive effect in participants' vocabulary learning performance.

Students' Attitudes Towards Using Apps in the Classroom. Rezaei et al. (2014) indicated that students had a positive attitude toward mobile-assisted learning because it is more student-centered and allows personalized learning. This is supported by Godwin-Jones (2011) in his research about mobile apps for language learning. The author stated that mobile devices "are ideal for individualized informal learning" (p. 8). In addition, mobile learning creates excitement and offers a variety of ways for interacting with the material (Rezaei et al., 2014). Nisbet & Austin suggest that this motivation can be used to foster "enthusiasm for words and the vocabulary learning process" (2013, p. 5). The user can decide which apps to get and the way to use them to maximize learning (Godwin-Jones, 2011). Nisbet & Austin indicate that students who use these resources can increase their vocabulary knowledge by accessing speaking, listening, reading and writing activities.

Recommendations on Using Apps in the Classroom. Even though students are familiar with apps, students might not know how to use them effectively for language learning (Nisbet & Austin, 2013). The following steps are suggested when teachers want to introduce a new app to the class: build upon students prior knowledge, model the ways in which students can use the app, have students practice with the app in class, then independently encourage students to provide feedback on their learning experience (Nisbet & Austin, 2013). In the study by Rezaei et al. (2014), parts of the apps were assigned for students to study in advance, in order to ensure that the students were familiar with the apps and the key features they offer. Later in the experiment a new part of the app was assigned. The purpose of these training sessions is "to reduce the effects and limitations of the use of a new tool" in the results of the study (p. 77). In the study by Yafei & Osman (2016), students in the experimental group received a tutorial regarding the use of the app, as well as answers to questions about the Ko-Su app and vocabulary exercises. The researchers also provided students with a printed copy of the user manual to be used as needed during the study.

SMS

Short Message Service (SMS) is the most widely used type of text messaging. Due to its popularity, educators had explored using SMS in educational settings. The amount of information sent is limited, as with SMS you can send a message of up to 160 characters to another device. Teachers can use SMS text messages to send small lessons, exercises and quizzes to students. Several researchers had explored the effect of SMS instruction for vocabulary learning (Lu, 2008; Zhang et al., 2011; Derakhshan & Kaivanpanah, 2011; Alemi et al., 2012; Suwantarathip & Orawiwatnakul, 2015; Motallebzadeh & Ganjali, 2011; Kim, 2011).

Lu (2008) and Zhang et al. (2011) found that students using SMS lessons to learn vocabulary were more effective than the students using paper material. Lu completed a 2-week study with 30 Taiwanese high school students. The participants were expected to learn 28 vocabulary words. The first week participants in the SMS group learned the first 14 target words via mobile phone. In the second week the two groups switched conditions for the other 14 words. Results from the first week post-tests indicated that the difference of the immediate gains between the two groups reached a significant level (two-tailed t-test; $t(28) = 2.620$, $p < 0.05$). However, none of the gains in the delayed post-test in the four groups reached the significant level. The researcher also found that more frequent SMS reading resulted in higher vocabulary gain. Some limitations of the study identified by the researcher include, the self-reported frequency of reading SMS vocabulary lessons, the limited number of words, as well as the short experimental time. Zhang et al. found similar results working with 78 students learning 130 words during a 3-week period.

Conversely, Derakhshan & Kaivanpanah (2011), and Alemi et al. (2012) found the effect of text messaging on vocabulary learning not to be statistically significant. Derakhshan & Kaivanpanah worked for 6 weeks (twelve sessions) with 43 university students enrolled in an English class. Students in both the experimental and the control group were asked to build sentences in class, as well as to work cooperatively in small groups of 3 to 4 to increase their exposure to the target words (about 200). The participants completed a post and a delayed test to analyze short and long-term vocabulary retention. From the independent samples t-test, the researchers found that the effect of text messaging on vocabulary retention was not statistically significant ($t(41) = 1.63$, $p < 0.1$). This finding is consistent with the findings from Lu (2008) and Zhang et al. (2011).

Alemi et al. (2012) argued that SMS used for language learning not only has a positive effect on vocabulary learning but also in vocabulary retention. In their study with university freshman students, 17 participants were assigned to the control group and 28 to the experimental group for a sixteen-week long study. Students in the control group received 10 words twice a week via SMS, while students in the control group were asked to look up 10 words in a dictionary and learn them for a total of 320 words. The researchers found that the experimental group was more effective in vocabulary learning. However, a t-test result ($t=1.48$, $p= .42$) shows that there was not any significant difference between the two groups in the post-test. Lastly, the researchers found that there was a significant difference between the two groups in the delayed post-test. Students receiving the words through SMS did better than those using the dictionary. This result is not in line with the three previous studies (Derakhshan & Kaivanpanah, 2011; Zhang et al., 2011; Lu, 2008).

Suwantarathip & Orawiwatnakul (2015), Motallebzadeh & Ganjali (2011), and Kim (2011) focused only on students' vocabulary gains after treatment (short-term retention). In the three studies, the researchers found similar results from Lu (2008) and Zhang et. al. (2011). The vocabulary gains of the SMS group were greater than the control group. In their 7-week study with 80 undergraduate students, Suwantrarathip & Orawiwatnakul found that using mobile computers to complete exercises had a significant effect on vocabulary ability. The control group completed paper-based vocabulary exercises and the experimental group received the vocabulary exercises via SMS on their mobile phones. Students were expected to learn 100 vocabulary words. The post-test mean of the SMS group was 33.25 while the mean of the paper-based group was 29.7. The t-test results indicated a statistically significant difference between the two groups after treatment.

Motallebzadeh and Ganjali (2011) not only examined the effects of SMS on vocabulary retention but also on reading comprehension ability. Fifty target words were sent three times a week during the 5-week treatment. These messages included 3-4 words as well as definitions and examples. In order to facilitate the reading of the messages, the "descriptions and examples were as short as possible" (Motallebzadeh & Ganjali, 2011, p. 113). Participants in the control group received a list of the target words on paper also followed by definitions and examples. The researchers found that the experimental group significantly outperformed the control group in vocabulary retention and reading comprehension.

Kim (2011) went one step further and investigated the effects of interactivity on SMS text messages to learning vocabulary. The 62 participants in the 6-week study were divided into two experimental groups and a control group. The difference between the two experimental groups was related to interactivity. One experimental group received and did not send any text messages back, whereas the second experimental group received and sent texts to answer quizzes. The researcher found that the two experimental groups showed greater improvement in vocabulary learning than the control group, which supports the potential benefit of mobile language learning. Furthermore, the researcher found that the group sending and receiving SMS text messages had the most improvement in vocabulary learning among the 3 groups. The researcher concluded that the effect of SMS instruction was significantly positive for vocabulary learning in the target language.

Overall, research studies found that students benefited from using SMS as a learning tool. According to Lu (2008), students were more motivated to learn using SMS lessons because the information was delivered in smaller chunks than the traditional paper material. The easy access to the vocabulary words through mobile devices supported retention of the material. Zhang's

study (2011) and Alemi et al. (2012) suggested that, vocabulary retention is only maintained when students have repeated exposures with the material. Constant access to the vocabulary through mobile devices provided this repeated exposure. Derakhshan & Kaivanpanah (2011) suggested that a blended approach to vocabulary learning in which mobile devices and paper material are used may be more effective. They also suggested that using SMS lessons contributes to a more learner-centered classroom in which students can be guided on ways to use their mobile devices to strengthen their vocabulary knowledge.

SMS Vocabulary Learning and Spacing Effect. In order to maximize the learning outcomes, the researchers considered the spacing effect, as learning is greater when studying is spread out over time. The participants received SMS text messages at specific times throughout the intervention. For example, in the study by Suwantrarathip and Orawiwatnakul (2015) the students in the experimental group got messages with exercises from the teacher after class via SMS. Then, the students received correct answers with explanations before the teacher sent the next exercise. In Lu's study (2008), words were delivered to the experimental group twice each day during students' commuting time (7 am and 5 pm) from Monday afternoons to Thursday afternoons. Similarly, in the study by Derakhshan and Kaivanpanah (2011) students in the mobile group received and reviewed the text messages at specific intervals. Students found this beneficial "as they did not need to resort to massed practice" (p. 52), they sent their SMS messages in the mornings and afternoons.

Zhang et al. (2011) gathered information prior to the start of the experiment regarding the participants' preferred times of message delivery. An SMS message consisting of 5 vocabulary items was sent out on a regular basis twice a day (one at 12 pm and the other at 5:30 pm). In the study by Alemi et al. (2012) the participants also received the SMS messages two times daily.

The students in the experimental group received 10-word definitions and example sentences in each attempt. Some researchers distributed SMS messages less frequently. For example, in Kim's study (2011), the students in the mobile groups received SMS text messages with 15 words two times a week. In the study by Motallebzadeh and Ganjali (2011) the messages were delivered three times a week on even days at 9.00 p.m. Each message contained three to four words with synonyms and examples. Students in the mobile groups indicated the delivery of the text messages at a regular time was beneficial.

Instructional Lessons and Activities on Mobile Devices

Some researchers explored the effects of different types of learning materials for mobile devices in learning vocabulary in a foreign language class (Agca & Özdemir, 2013; Miyakoda et al., 2011; Khazaie & Ketabi, 2011). For example, Agca & Özdemir (2013) explored the effect of mobile devices on students' vocabulary learning, and their opinions on vocabulary learning with mobile devices. The participants in the study consisted of 40 university students, divided into two groups. The researchers used a pre-test, post-test and questionnaire for data collection. Results of the t-test determined that there was a significant difference between the pre-test and post-test ($T_{(39)} = 2.745$, $p < 0.05$). This indicated that using mobile devices to support language learning increases students' vocabulary knowledge. In order to build this learning environment, the researchers used the printed course book, online learning material and Microsoft Tag (2010). Students had a positive attitude regarding Microsoft Tag, as it helped to connect the printed material with the online material, given students access to words' definitions and images. When asked about their preferences in ways to learn new words, 37.5% found the inclusion of pictures to be helpful and 32.5% placed a high value on the use of definitions and other objects. In general, students found the learning environment with mobile devices innovative, attractive and

motivating.

Similarly, Miyakoda et al. (2011) used different types of learning materials on mobile devices to support language learning. The researchers completed two experiments to test the efficacy of different types of data in vocabulary learning, including approaches that involved translation, visual, and auditory content. Even though the effectiveness of visual data was not conclusively proven in either experiment, the results of participants' questionnaire responses indicated that learners felt the use of visual data facilitated their learning process. This is consistent with findings from previous studies included in this review (Agca & Özdemir, 2013; Rezaei et al., 2014).

Khazaie & Ketabi (2011) went a step further from Miyakoda et al. (2011), in addition to developing different types of learning materials for mobile learning, they carefully considered the participants' visual and verbal abilities. One hundred fifty-eight students from an Iranian English institute took a visual short-term memory (STM) ability test and a verbal STM test. Learners were divided into four groups according to their test scores: Group 1 (high visual-verbal), Group 2 (high visual, low verbal), Group 3 (low visual-verbal), and Group 4 (low visual, high verbal). The researchers explored using written English words, their pronunciations, meanings in the native language (type 1 learning material) compared to using pictorial and written annotations to augment the type 1 learning material (type 2 learning material). Learners were expected to learn 20 vocabulary items, presented to them for about 120 seconds through their mini laptops. Then, participants took a recognition test followed by a recall test. From the test results, the researchers concluded that using annotations was more beneficial for learners with high-verbal and high visual ability (Group 1). In contrast, they found that type 2 materials were not beneficial for learners with low visual and low-verbal abilities (Group 3). They also

found that learners with similar abilities than those in Group 2 have better vocabulary learning with materials with pictorial annotations, whereas learners with similar abilities than those in Group 4 learn better from materials with written annotations.

Authentic Content Creation for Vocabulary Learning

Other researchers focused on vocabulary learning via mobile-assisted authentic content creation and social meaning-making (Wong & Looi, 2010; Qin, 2015). The researchers explored the potential of transforming language learning into an authentic seamless learning experience. Wong & Looi (2010) defined seamless learning mediated by one-mobile-device-per student as the seamless integration of the learning experiences across a variety of learning settings (formal and informal learning, individual and social learning, and learning in physical and digital settings). The purpose of these activities is to help students who are eager to learn anytime and anywhere become active learners. Wong & Looi (2010) completed two case studies using a sample group of elementary students with 40 second graders in the first study and 40 fifth graders in the second study. The researchers found that participants had a positive attitude towards the learning experience. In the first case study students were introduced to six English prepositions. Then, students went outside of class to take pictures depicting the six prepositions. Back in class students shared their pictures with the class and completed a fill-in-the-blank exercise using the studied prepositions. Students created an illustrated story using mobile devices; and selected students shared their work with the class. The mobile-assisted lesson lasted two hours. Students enjoyed working with peers and showing their work in class. The teacher mentioned that students were able to show their understanding of the prepositions.

In the second case study involving fifth graders (Wong & Looi, 2010), students learned six Chinese idioms. Students took pictures to illustrate the studied idioms, then they shared their

photos and comments using a wiki page, students completed peer reviews on the wiki page as well. Lastly, the teacher facilitated an in-class discussion for students to share their knowledge on the six idioms. The experiment lasted nine weeks. The researchers found an uneven level of participation among students. From the interviews with teachers and students, the researchers were able to identify the causes for the unequal participation. Students were very engaged during the lesson in class, but the after-school involvement with the material was affected by different factors: Students did not take advantage of the devices outside of the formal setting, they treated the devices as a "new toy" (p. 427); some students experienced technical problems as they completed a post using their mobile devices. Students' work and participation "showed great potential and promise" (p. 427) even though the challenges mentioned.

Qin (2015) found similar results to Wong & Looi (2010) when studying authentic content creation for vocabulary learning with a sample group of 47 university students learning Chinese as a foreign language. 25 participants were in the experimental group and 22 in the control group. The researcher found that the mobile-assisted seamless learning activities had a positive effect on enhancing Chinese vocabulary learning. Results of post-tests indicated that there was a significant difference between the two groups, the mean score of the experimental group was 9.033 and the control group was 8.345. The results confirmed that the out-of-class activities improved students' performance. Participants had a positive perception of the mobile-assisted learning out-of-class activity. Using a four-point Likert-type questionnaire, the researchers found that students felt the activity was helpful to learn the target vocabulary (mean =3.32) and they would like to participate in this type of learning activity in the future (mean = 3.31).

Perceptions of Mobile Devices in the Classroom

Research suggests that attitudes of teachers, prospective teachers, and students play an important role in the adoption use and success of mobile devices in the teaching of language and vocabulary. (Thomas & Muñoz, 2016; Dogan & Akbarov; 2016; Cakir, 2015; Grant & Grant, 2013). Some researchers explored the views of students on specific mobile devices used for foreign language learning (e.g. Electronic dictionaries, tablets, and smartphones) (Kobayashi, 2008; Chen, 2013; Muhammed, 2014). Researchers also investigated the perceptions of students on using apps for language learning (Muhammed, 2014; Steel, 2012; Niño, 2015). Lastly, researchers examined students' perspectives on the use of SMS in a language course (Lu, 2008; Zhang et al., 2011; Kim, 2011; Hu, 2011; Suwantrarathip & Orawiwatnakul, 2015).

Teachers' and Prospective Teachers' Perceptions

Mobile technologies will not be used in the classrooms unless the teachers see value in their use. Existing studies have surveyed teachers at the K-12 and university level (Bensalem, 2019; Dogan & Akbarov, 2016; Nikolopoulou, 2020). They have also questioned prospective or pre-service teachers about their opinions on using mobile technologies in the classroom (Cakir, 2015). Generally, the educators had a positive attitude towards using mobile technologies (Bensalem, 2019; Dogan & Akbarov, 2016; Nikolopoulou, 2020)

University Teachers. Bensalem (2019) surveyed 150 university teachers. The researcher found that respondents had a positive perception of mobile devices and applications in their teaching and learning. Most of the English as a foreign language teachers (M=4.43, SD=.74, using 5-point Likert type scales) indicated their willingness to learn how to integrate mobile devices and apps in their teaching practice, as they believe that mobile devices can enhance students' learning (M=4.22, SD=1.06) and create opportunities outside of class (M=4.25, SD

.91)

K-12 and University Teachers. Dogan and Akbarov (2016), working with high school and university teachers, found similar results to those of Bensalem (2019). The researchers surveyed 159 teachers from public and private schools and universities. Respondents had a positive attitude toward using mobile devices in the educational setting. A majority of teachers (83%) would use free mobile content for their own professional development. In terms of using mobile learning with students, 69% would use free mobile learning content and 50% would use e-books. On the other hand, Dogan & Akbarov found that lack of training and students' attitudes were the two main obstacles to using mobile devices for teaching.

K-12 Teachers. In the study by Nikolopoulou (2020), the researcher reported the perceived benefits, constraints and concerns of mobile phone and tablet use in classrooms, among secondary teachers in Greece. Based on responses to an open-ended questionnaire, it was found that the two main benefits of using mobile devices in the classroom were student interest/excitement (86%) and an attractive interactive environment (57%). The main barriers to using mobile devices centered on legislation that regulates the use of mobile devices in classroom settings (57%) and availability of equipment/resources (about 43%). Concerns about classroom management and student misbehavior were also frequently mentioned.

Prospective Teachers. Cakir (2015) worked with 193 undergraduate prospective English teachers in Turkey, to explore their views of mobile devices for foreign language instruction and learning. Results from a 10-question survey showed that 58.5 % of the prospective teachers are in favor of using mobile phones for educational purposes. Moreover, 66.3% of the participants reported they would like to use mobile phones in class as an instructional tool. In addition to this, the participants expressed that language learning is more attractive and motivating to students

when teachers use technology as part of the teaching environment. Despite these positive perceptions, the researcher found that only 45.6% of the prospective teachers responding reported receiving encouragement from their own teachers.

Students' Perceptions

Students' perceptions and their preferences such as the use of mobile devices in learning are important factors for teachers to consider. Some studies involved surveying students at both the high school and university level regarding their opinions of using mobile technology in their studies. These studies also included their perceptions about using mobile devices in the classroom.

High School Students. Thomas and Muñoz (2016), after surveying 628 high school students, found that students see benefits associated with using mobile devices in the classroom. However, students indicated having some concerns about the integration of mobile devices in the classroom. The main benefit identified by students was "the potential of mobile phones to reduce the digital divide (p. 28). The researchers found that 90.9% of students owned smartphones and 9.1% owned a basic mobile phone. From the students participating, 90.7% of them reported using phones for school-related work. It was also found that students' average rate of expertise with technology was 4.24, which indicates that students seemed to have more technology expertise than the teachers (M = 3.71). Some of the challenges mentioned by students were ringing phones during class, using phones to cheat, and participating in "harmful activities like cyberbullying and sexting" (p. 30). Students also mentioned that they only used their phones for low-tech activities.

University Students. In a qualitative research study, Gikas and Grant (2013) worked with university students. Nine participants were selected from three different universities.

Students participated in focus group interviews. The participants commented on the advantages of mobile devices for learning, as well as the challenges when using them. The advantages identified by the participants included the quick access to the information, the opportunity to collaborate and communicate with others about the content. In addition, students mentioned that mobile devices provide the opportunity to learn the material in different ways and give access for students to learn in real world setting. On the other hand, students expressed some of the frustrations that come from learning with mobile devices. Students commented that “universities provided inconsistent messages about the use of mobile computing devices" (p. 23), as some instructors did not seem to be in favor of technology while others encouraged it. This is consistent with Cakir’s (2015) findings. Additionally, Gikas & Grant found that students had some problems with applications in their devices that did not work. Another challenge was the small keyboards on some devices for typing responses.

Recommendations for Policy and Practice. Regarding the harmful activities students mentioned in the study by Thomas and Muñoz (2016), the researchers suggest that the schools should provide clear policies on using mobile devices in the classroom. In order to address the concern of the students regarding using phones for low-tech activities (Thomas & Muñoz, 2016) and lack of teacher’s training (Dogan & Akbarov, 2016), Thomas & Muñoz suggest that teachers should receive training on ways to integrate mobile devices more effectively in their classrooms. Furthermore, Thomas & Muñoz suggest that schools should provide teachers with time to collaborate and discuss best practices on mobile devices in the classroom. Dogan & Akbarov recommend that teachers should have mobile devices for teaching provided by the administration. The researchers also encouraged conversations between teachers and students about their views of mobile devices for learning (Dogan & Akbarov, 2016). Students should seek

teacher guidance as they use their devices. Students may receive help not only from the teacher but also from peers (Gikas & Grant, 2013; Dogan & Akbarov, 2016). Lastly, Gikas & Grant identified the role of students and teachers for a successful implementation of mobile language learning, "Students may drive technology integration; however, it is the instructor who must lead effective ways to implement devices in learning" (p. 24).

Devices Used in the Classroom and Students' Perceptions

Some researchers examined the use of specific mobile devices in the classroom and students' opinions on these devices. For example, Kobayashi (2008) conducted a mixed-method study to examine the use of an electronic dictionary (ED) compared with a paper dictionary (PD), as well as the students' perceptions of them. The researcher also examined their impact on students' dictionary use. In another study regarding the use of mobile devices for learning, Chen (2013) explored using tablets in language learning outside of class. The author also examined how to help students find ways to use their tablet more effectively as they learn independently. On the other hand, in a study by Muhammed (2014), the participants used smartphones as mobile tools to improve their language learning. The researchers conducted their studies with undergraduate university students of English (Kobayashi, 2008; Chen, 2013; Muhammed, 2014). They used semi-structured interviews, questionnaires, and daily reports for data collection.

Kobayashi (2008) conducted three different studies, the first study was completed with 279 participants; the second study was conducted with the participation of twenty-two students from the previous study. The last study was conducted with new participants. From the three studies, the participants mentioned as advantages of EDs: portability, search speed, a jump function for users to move from one dictionary to another, spell check and idiom search function. On the other hand, the disadvantages mentioned by students were the lack of detailed

grammatical information and the small screen. Also, as advantages in Study 2 participants mentioned the capability of making notations, the quality of information, the ease of use, the illustrations and how PDs helped with word retention. On the other side, the participants identified the limited headwords, the weight of the dictionary, the time-consuming search process, as disadvantages. Students who used both electronic and printed dictionaries mentioned that they used them for different purposes. For example, they used a PD to look at examples and detailed usage and grammatical information. On the other hand, they used an ED to find the meaning of a word faster. From the findings, the researchers recommended that teachers encourage students to use EDs and PDs "according to their purposes" (p. 778).

On the other hand, Chen (2013) used a two-cycle procedure to assess students' daily learning activities with tablets. The researcher found that participants had a positive opinion on using tablet computers for language learning. Results from the background survey indicated that 7 of the 10 participants believe that mobile devices are helpful tools for language learning because of the easy access and ease of use. In cycle 1, students received instructions on how to use the device. Students were asked to report daily on their experiences with tablets. From the data collected, it was found that students spent an average of 2.39 hours on their tablets daily. Out of this time, they spent 0.61 hours on average learning English. In cycle 2, students were encouraged to use their tablets for independent and collaborative learning. After the two cycles, students reported the advantages and challenges they saw when working with tablets. Students stated that tablets were easy to use, they had fast WiFi connection, expandable apps installation, and portability. Some challenges mentioned by the participants were WiFi availability, system operation, and not knowing how to evaluate language learning apps. The researcher found that the instructor should provide instructions on how to best use this tool to maximize learning.

Also, the author suggested that a supportive learning environment should exist to help when users are experiencing problems. Overall, participants perceived mobile devices as effective tools for language learning, which is in line with previous studies mentioned (Rezaei et al., 2014; Dogan & Akbarov, 2016).

Muhammed (2014), using a sample size of 20 university students, found that all the participants agreed on the effectiveness of mobile devices in their language learning experience. In addition to using smartphones for language learning due to its portability, participants mentioned its compatibility, as English is the only language of most of the apps that they used for English language learning. These apps related to English language skills, integration of language skills and language system, and international tests.

Students' Perceptions of Mobile Applications

Some researchers investigated students' perspectives on using mobile apps in general, for foreign language learning (Steel, 2012; Niño, 2015). While previous studies included in this review mentioned the instructional benefit of using specific applications on mobile devices (Sato et al., 2015; Berns et al., 2015; Rezaei et al., 2014), students shared their perceptions about these applications. The researchers used focus group discussions, surveys, and internet-based questionnaires for data collection (Steel, 2012; Rezaei et al., 2014; Sato et al., 2015; Niño, 2015; Berns et al., 2015;).

Steel (2012), using a rather large sample size (N=590), found that students perceived mobile apps for language learning as beneficial. Along with the ability to connect with the target language outside of the classroom, participants mentioned that mobile apps allowed them to work at their pace, which gave them the opportunity to fit the study of the target language into their busy schedules. One student stated, "it's turned my transit time into 80% of study time" (p.

877). In addition to this, Steel found that 56% of the 590 participants reported using mobile apps for their university learning, and 23% of them ranked mobile apps in the top three technologies. Students also commented how apps were easy to find, and they were generally free or low cost (Steel, 2012). Similarly, in a study by Niño (2015), 48% of the participants found the ability to access apps for extra practice anytime and at their own pace to be beneficial. Niño worked with 252 participants, including non-specialist students, non-credited students and members of the public. Niño found that 64% of the participants have used mobile apps to support their language learning.

More specifically, Steel (2012) found that apps not only benefit students with vocabulary, but also with reading, writing, grammar and translation tasks. Niño (2015) found that 73% of the participants reported that apps helped them increase their vocabulary in the target language by providing help in memorizing words, phrases, conjugations, etc. Suggestions for ways to integrate mobile apps in a language class included among others, posting links to helpful apps by teachers or students, assigning problem solving tasks as homework, and using interactive games to support the learning of the material (Niño, 2015). In both studies (Niño, 2015; Steel, 2012) participants identified the apps they used for language learning. The students mentioned dictionary apps, translation apps, language practice apps, conjugation apps, flashcards apps, and games.

Other researchers found that using apps not only had a positive effect on language performance but also in motivation and confidence. For example, Sato et al. (2015), working with 97 undergraduate students using Quizlet, found that the experimental group felt more motivated to learn the vocabulary than students who used the traditional paper-based material. In the study by Berns et al. (2015), students became more confident in the target language as their

writing skills improved due to the interaction with the *Guess it! app*. However, 16% of the participants reported dissatisfaction towards the app. The app was designed for android operating system, as consequence students with an iPhone could not install the app and had to use other students' devices, which limited their access to the app. Rezaei et al. (2014) investigated the impact of Busuu and Interactive English mobile apps in language learning, using a sample size of 42 participants. About 83% of the participants mentioned that the applications were effective in their learning performance, about 85% felt more confident after using the apps, and about 78% agreed that the apps had a positive effect on their class participation. Lastly, 89% of the participants felt that using multimedia for learning has a positive effect.

Students' Perceptions of Language Learning Through SMS

Addressing a tool that is more important in the students' lives, researchers studied students' perceptions of using texting (SMS) for learning vocabulary (Lu, 2008; Zhang et al., 2011; Kim, 2011; Hu, 2011; Suwantrarathip & Orawiwatnakul, 2015). In order to explore students' attitudes on using SMS text messages for vocabulary learning, the researchers used open-ended questionnaires, surveys, and interviews. For example, Lu (2008) found that students in general had a positive opinion on using SMS text messaging for vocabulary learning. The researcher worked for 2 weeks with 30 high school students. Students' answers regarding the advantages of learning vocabulary via mobile devices can be summarized as: convenient and effective time management (over half of the participants), it is a fun way to learn (25%), and SMS lessons were short and easy to read which made content manageable (17%). However, 23 of the participants mentioned some disadvantages of using mobile devices to learn vocabulary. 26% of participants commented on the limitations of the content, such as lack of example sentences, and the limitations of using phonetic symbols in the SMS lessons. 22% of participants

commented on technical problems such as the amount of memory used of their device; and 19% found difficult to study because of the difficulty finding a word when wanting to review, as well as the difficulty to concentrate in learning on the move.

Zhang et al. (2011) found similar results working with 78 students. Participants in the experimental group completed an open-ended questionnaire regarding advantages and disadvantages of using SMS text messages for vocabulary learning. Students mentioned that they felt more motivated to learn through SMS-based learning opportunities. Using phones is convenient as they can use it anytime and anywhere. A student commented regarding taking advantage of fragmented time, “reading words from text messages is really a time killer during meals, and it helped us to make full use of fragmented time” (p. 208). The message also reminded students to study the words. Students found that it was more efficient for them to memorize target words within a given period as they were exposed to the regular limited number of words each day. This finding is consistent with Lu’s (2008), chunking the material makes a huge learning task more manageable for the learner.

Likewise, in the study by Kim (2011) students commented on the benefits and drawbacks of vocabulary learning through SMS. The 62 participants were divided into three groups: Control group, Experimental Group 1 (EG1) and Experimental group 2 (EG2). Students in the EG1 received and did not send any text messages back, whereas participants in the EG2 received and sent texts to answer quizzes. Students in the experimental groups completed a survey; and two students from each experimental group (EG1, EG2) completed an in-depth interview. The participants commented on the benefits of accessing the messages with the words anytime and anywhere. The students found using SMS in foreign language learning enjoyable and effective. The drawbacks of vocabulary learning through SMS found by Kim included, short saving

capacity of mobile phone, as well as small screen device (11.6% of participants). About 49% of participants commented on challenges associated with reading text messages in busy hours, and about 12% commented on the challenges of receiving many text messages at a time. In addition to this, the researcher found that students in the group with interactivity seemed to check the texts sooner than those without interactivity, as the students with interactivity needed to receive and send the texts messages to answer the quiz. The researcher concluded that students showed more preference and proved more benefits to learn new words by interacting with teachers through SMS. In general, students had a positive attitude on learning vocabulary words through SMS.

In the study by Hu (2011), the researcher examined the opinions of 24 English major students on mobile devices for language learning. During the four weeks of treatment, participants received the new vocabulary through a free text message software called Fetion. Students completed a survey on mobile devices use for language learning. Similar to what was found in the studies mentioned above (Lu, 2008; Zhang et al., 2011; Kim, 2011), students used commuting or waiting time to read the messages because of the accessibility and portability of mobile devices, allowing students to practice the vocabulary outside of class. Students had a positive opinion regarding their mobile phone learning experience, with an average score of 4.3 (on a scale from 1 to 5). Just a few students (mean=1.74) considered vocabulary text messages as distraction. In general, students expressed their preference for learning vocabulary using mobile devices, and their motivation to continue using them as learning tools. They mentioned that receiving the text messages helped them to remember to practice the material, which increased their motivation for learning. This is consistent with the findings in the study by Lu (2008). Suwantrarathip & Orawiwatnakul (2015) found similar results using a slightly larger sample size

(N=80). Students in the control group completed paper and pencil vocabulary exercises while participants in the experimental group received vocabulary exercises via SMS text messages. Students in the experimental group completed a questionnaire regarding their attitudes towards mobile-assisted vocabulary exercises. The researchers found that students show a positive attitude in all statements included in the survey (mean =3.98). Table 1 shows some of the statements included in the questionnaire. Students found that using mobile computers for vocabulary learning is convenient because they can access their devices anywhere, anytime, similarly to Lu (2008), Zhang et al. (2011), and Kim (2011). Additionally, the researchers found that mobile computers not only increase students' success with vocabulary learning but also their learning motivation.

Table 1. Mean, Standard Deviation, and Level of Attitudes of the Students

Statements	Mean	SD	Level
SMS exercises help me memorize new words.	4.15	.58	positive
SMS exercises make learning more interesting.	4.10	.54	positive
SMS exercises are convenient and easy to get access.	4.02	.80	positive
SMS exercises enable me to review the vocabulary	3.80	.68	positive
SMS exercises make me want to learn new vocabulary	3.82	.78	positive

Note. Adapted from "Using mobile-assisted exercises to support students' vocabulary skill development" by Suwantrarathip, O., and Orawiwatnakul, W., 2015, The Turkish Online Journal of Educational Technology, 14, p. 168

Recommendations of Using SMS for Vocabulary Learning. Students offered suggestions when using SMS for vocabulary learning. In the study by Lu (2008) a participant

expressed the challenge of staying on task while checking the SMS lessons, “although the SMS lessons were good. I liked playing games more” (p. 520). To this challenge, participants suggested a tracking mechanism to monitor students’ behavior and intervene in time to offer assistance. In the same way, participants in Kim’s study (2011) provided some recommendations. Participants suggested using SMS not only for vocabulary learning but also for grammar learning. 11.1% of students suggested reducing the amounts of words given in SMS; and have text messages more than twice a week. About 8% of participants from the EG1 indicated that they wanted to receive feedback after getting the text messages. 5.6% of students mentioned the need to be checked with either a quiz or vocabulary test every week. Other participants suggested adjusting the level of vocabulary based on each student’s ability (5.6%). Lastly, participants in the study by Zhang et al. (2011) suggested a blended approach to vocabulary learning. Students mentioned how they use other tools to supplement their vocabulary learning experience, such as writing down the words on paper as they received them.

Conclusions and Recommendations

This literature review was completed to examine research about the use of mobile computing in vocabulary learning in the foreign language classroom. The first theme identified in this review is the effect of using mobile devices for vocabulary learning compared to traditional methods. Another theme that emerged from the research was the perceptions of teachers and students regarding the use of mobile devices for school work. Several studies included in this review examine vocabulary learning using mobile devices, along with the experience of students with the use of mobile computers. Other researchers exclusively examine the perception of students and teachers regarding the use of mobile devices in the classroom. Some of the articles included teachers and students interviews regarding the use of mobile vs.

paper material.

Student use of mobile devices yielded benefits in vocabulary language learning. Some of the strategies mentioned in this review were the use of electronic dictionaries, SMS, online tools, and software to aid vocabulary learning in the foreign language classroom. All of these digital tools were compared to the use of paper-based material for vocabulary learning in a foreign language classroom. Sato et al. (2015) found that the use of mobile devices not only improves vocabulary learning, but the use of technology may also improve students' motivation for learning. This motivation can be used to stimulate interest in the target words and the vocabulary learning process (Nisbet & Austin, 213). Zhang et al. (2011) see the benefits of both approaches - the traditional paper and pencil as well as the use of mobile computers, and they suggest a blended approach.

The results of vocabulary pretests, posttests and delayed tests indicate that the use of mobile computers improve students' language ability more than the use of paper material (Rezaei & Davoudi, 2016; Zhang et al., 2011). From the interviews with teachers and students regarding the use of mobile devices for learning it was found that there are benefits and challenges associated with the use of mobile computers for vocabulary learning in the classroom. Some of the challenges identified by the participants were: the limited memory, small screen, and limited device capability, the need to orient teachers and/or students in the use of apps and devices, concerns about inappropriate use of mobile devices, and teachers not supporting the use of the devices in the classroom. The benefits mentioned included: more motivation to learn, the use of mobile devices anywhere and anytime, instant feedback from teachers, quick access to the material and the opportunity to learn the content through different stimuli (aural and visual).

Classroom Applications

The use of mobile computers guided by good pedagogical practices will benefit students in the foreign language classroom in recollection of vocabulary and language learning. It is important to have clear policies and procedures regarding the use of mobile devices in the classroom to minimize the challenges that the use of this tool possess regarding topics such as intrusiveness, and misuse of it among others. Teachers of foreign languages in a school may incorporate the use of mobile computers to support language learning. Teachers should continue to explore, establish, and evaluate best practices in the use of mobile teaching and learning because this tool has been shown to increase students' motivation for learning. All teachers, either at the school level or department level, should be part of the initiative of using mobile devices in the classroom to avoid sending mixed messages to students regarding the benefits of mobile computers for schoolwork.

Recommendations for Policy and Practice

Teachers and students must receive appropriate training on how to use mobile devices effectively. Nisbet & Austin (2013) suggest that students may be familiar with tools such as apps, but they might not know how to use them effectively for language learning. Some studies in this review included training students on specific apps used (Rezaei et al. 2014; Yafei & Osman, 2016). One of the two main obstacles to using mobile devices for teaching found by Dogan & Akbarov (2016) was the lack of training. The IT personnel should be able to assist teachers and students when technical difficulties occur while using mobile devices in the classroom. If teachers feel comfortable with the use of technology in their classrooms, they will be more willing to take advantage of these technological tools. Teachers can support each other by sharing ideas and activities for mobile vocabulary learning. Gikas & Grant (2013) mentioned

that “students may drive technology integration; however, it is the instructor who must lead effective ways to implement devices in learning (p. 24). Another obstacle to mobile devices for teaching identified in the research, was the opinions of students (Dogan & Akbarov, 2016). The researchers suggest that teachers and students should have conversations regarding their views of mobile devices for learning. For successful technology integration in the educational setting, it is necessary that teachers and students have similar views on technological tools.

Using mobile computers in the foreign language classroom will not only benefit students’ vocabulary learning but will also promote the learning of other skills. With the use of mobile computers, students can collaborate on class projects, practice vocabulary with classmates and ask other students questions when they have problems with the material. This collaboration can happen not only in school but also outside the classroom, and it can be synchronous or asynchronous. Apps can help the class to become a community of learners. The app used in the study by Berns et al. (2015) gave users the opportunity to collaborate with other users as they built their knowledge in the target language.

Students expressed some concerns when using mobile phones in the classroom: ringing phones, using phones to cheat and participating in activities like cyberbullying and sexting (Thomas & Muñoz, 2016). The researchers suggest that schools should provide clear policies on using mobile devices in the educational setting. Just a few students (mean = 1.74, N= 24) considered mobile devices in the educational setting as distraction.

Recommendations for Future Research

Some topics for future research could be classroom management strategies and how schools and teachers are addressing the negative consequences of using mobile computers in the classroom. Another topic for research is to explore which learning environments have lower

amounts of inappropriate mobile device usage, and which characteristics in those environments can be replicated elsewhere. Mobile computers can be used in foreign language instruction to improve and accelerate the learning of the target language. Mobile computers offer many benefits; however, consideration of challenges needs to be explored as well. Also, the views and dispositions of students and teachers need to be considered when using mobile computers in the classroom. Students and practitioners see the benefits of the use of mobile computers to improve vocabulary learning.

Most studies reviewed in this paper were conducted in the post-secondary level. In addition to the above topics for future research, research on the use of mobile devices to support language learning at the secondary level is necessary to fill the research gap. This research could explore the benefits of mobile computers in high school students' vocabulary learning in general, and more specifically in Spanish language learning. As a Spanish language teacher this would be of interest to my colleagues and me.

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